Detailed Syllabus
Lecture-wise Breakup

Course Code	17M11CS121	**Semester** ODD **(specify Odd/Even)**	**Semester** IInd DD VIII **Session** 2018 - 2019 **Month from** January 2019 – June 2019
Course Name	**Cloud and Web Services Software Engineering**		
Credits	3-0-0	**Contact Hours**	…

Faculty (Names)	**Coordinator(s)**	Dr. Sandeep Kumar Singh
	Teacher(s) (Alphabetically)	…

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Demonstrate role of Software engineering in combining cloud and web services computing paradigms for application development.	Understand Level (Level 2)
CO2	Analyze the requirements for developing web services and migrating applications to Cloud Services.	Analyzing Level (Level 4)
CO3	Categorize various cloud services into compute, storage, database, application, analytics, network, and deployment.	Analyzing Level (Level 4)
CO4	Make use of cloud and service engineering process to design, implement, and test, deploy and execute reusable restful and soap based web services.	Apply Level (Level 3)
CO5	Utilize some of the real world web services GOOGLE,AMAZON,EBAY,PAYPAL,FEDEX ETC.	Apply Level (Level 3)
CO6	Appraise different design patterns, Reference Architectures, performance metrics, testing tools and design patterns for Cloud.	Evaluate Level (Level 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Distributed Software Engineering	Distributed Systems, Client and Server Computing, Architectural Patterns for distributed systems, Software as Service, Software Development Life Cycle for Cloud Platform, Software Design Strategies for Cloud Adoption	4
2.	Service-oriented software engineering	Service-Oriented Computing, Service-Oriented Architecture (SOA), Restful Services, Service Engineering and Service Composition.	6
3.	Introduction to XML and Wed Services	XML Technology Family, Structuring with XML- DTD, Schema, XML Processing, DOM,SAX, XML in Practice.	4
4.	Designing and Implementing Wed Services	Web Services and Web Service Technologies-SOAP, WSDL,	6
5.	Introduction to Cloud Services	Cloud Services, Cloud Deployment Models, Cloud Technologies and Open Source Software, Challenges - Scaling Computation, Scaling Storage, Multi-Tenancy, Availability, Limitations and Challenges in Cloud-Based Applications Development	6
6.	Requirements Engineering for Amazon Web service	Compute, Storage, Database, Application, Content Delivery, Analytics, Deployment and Management, Identity and Access Management, Salesforce.com, Microsoft Office 365, Box, Google Apps, Amazon Web Services, Concur, Zendesk, Dropbox, Slack etc	2

7.	Cloud Services from Amazon	IAM services-users, groups, policy and roles, Elastic Compute Cloud, Databases on Amazon, Storage on Amazon services,	6
8.	Address SE in Web services	Web Services Design Pattern, Metrics to Measure Web Service Performance.	3
9.	Address SE in Cloud services	Cloud Services Design Pattern, Metrics to Measure Cloud Service Availability, elasticity , Scalability, Load balancing, Auto scaling. Performance.	6
		Total number of Lectures	**43**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (To be mapped from Assignment 1,2 and 3)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Software Engineering Frameworks for the Cloud Computing Paradigm Zaigham Mahmood and Saqib Saeed
2.	Cloud Computing and Software Services Theory and Techniques **Syed A hson and** Dr. Mohammad Ilyas
3.	Engineering Long-Lasting Software: An Agile Approach Using SaaS and Cloud Computing Beta Edition 0.9.0 Armando Fox and David Patterson
4.	Cloud Computing: A Hands-On Approach Book by Arshdeep Bahga and Vijay K. Madisetti
5.	Cloud Computing Design Patterns Book by Amin Naserpour, Robert Cope, and Thomas Erl
6.	XML, Web Services, and the Data Revolution Book by Frank P. Coyle
7.	Software Engineering Book by Ian Sommerville
8.	Engineering Software As a Service: An Agile Approach Using Cloud Computing Textbook by Armando Fox and David Patterson
9.	Design Patterns: Elements of Reusable Object-Oriented Software with Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and the Unified Process by Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides, 2003
10.	Cloud-Based Software Engineering PROCEEDINGS OF THE SEMINAR NO. 58312107

Detailed Syllabus
Lecture-wise Breakup

Subject Code	17M11CS122	**Semester:** Even **(specify Odd/Even)**	**Semester** Even **Session** 2018-2019 **Month from** Jan'19 **to** June'19
Subject Name	Performance Evaluation of Computing Systems		
Credits	3-0-0	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Kavita Pandey
	Teacher(s) (Alphabetically)	Dr. Kavita Pandey

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Demonstrate the ability to describe the correct tools and techniques for computer system performance evaluation	Understand (level 2)
CO2	Identify the probability distribution in a given stream of data that corresponds to a source of randomness in a system.	Apply (level 3)
CO3	Design the appropriate model of a discrete, dynamic, stochastic system using the theory of random processes.	Apply (level 3)
CO4	Inspect the mathematical modeling techniques, Markov chains, queuing theory for analyzing the system.	Analyze (level 4)
CO5	Select the appropriate experiments and perform a simulation study of the given system.	Evaluate (level 5)

Module No.	**Title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Overview of Performance Evaluation	Need for Performance Evaluation, Systematic approach to Performance Evaluation, Selection of evaluation techniques and performance metrics	5
2.	Random Variables and Probability distributions	Discrete and continuous random variable, Expectation and variance, Bernoulli random variable, Binomial distribution, Poisson distribution, Geometric distribution, Normal and Exponential distribution, Normal approximation and Poisson approximation to binomial distribution, hazard rate function, , Comparing systems using sample data, Confidence interval	10
3.	Markov Process	Introduction and classification of stochastic processes, Discrete time and Continuous time markov chains, Birth and death processes , Transition probabilities, Steady state solution, Performance measure in terms of time spent and expected reward	6
4.	Queuing models	Basics of Queuing theory, Kendall notation, Little's Law, Analysis of a single queue	8

		with one server and multiple servers, Analysis of finite buffers queuing systems	
5.	Simulation modeling	Intoduction to simulation, Types of simulation, Random number generation, a survey of random number generators, seed selection, testing random number generators , random variate generation	6
6.	Measurement techniques and tools	The art of data presentation, Ratio Games	2
7.	Experimental design and analysis	Types of Experimental designs, 2^2 factorial designs, General 2^K factorial designs, 2^{K-p} fractional factorial designs	5
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (…)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Raj Jain, "The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation, and Modeling", Wiley, 1991.
2.	K.S. Trivedi, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2001.
3.	Ross, Sheldon M. “A First Course in Probability”. Upper Saddle River, N.J.: Pearson Prentice Hall, 2006
4.	Obaidat, Boudriga, "*Fundamentals of Performance Evaluation of Computer and Telecommunication Systems* ", 2010, Wiley, ISBN 978-0-471-26983
5.	Ross, Sheldon M. “Introduction to Probability Models”. Amsterdam: Academic Press, 2010.
6.	Fortier, Michel, "Computer Systems Performance Evaluation and Prediction", 2003, Elsevier, ISBN 1-55558-260-5

Detailed Syllabus
Lecture-wise Breakup

Subject Code	17M17CS121	**Semester:** EVEN **(specify Odd/Even)**	**Semester 2nd, Session** 2019 **Month from JAN to MAY**
Subject Name	PBL-II		
Credits	**2**	**Contact Hours**	0-0-4

Faculty (Names)	**Coordinator(s)**	1. Dr. VikasSaxena
	Teacher(s) (Alphabetically)	Dr. VikasSaxena

S . No	Course Outcome	Bloom's Level
CO1	Develop a project on research based topic by Applying software development lifecycle processes	Level-6, Create
CO2	Identify the issues related to development of project which includes team work, test driven design, data collections etc	Level-2,Understand
CO3	Prepare technical report detailing the software specification, design, test plan, and implementation details	Level-3, Applying
CO4	Will be able to critically review the projects developed by peers.	Level-4 Analyze

Module-1	Feasibility & Team making	Making a team as suggested in PBL Guideline, Study team Sprit, peer review ethics, Literaturesurvey and selection and reporting a problem statement, Understanding PSP and TSP, Open Source based development	12
Module-2	Analysis	Defining Scope, Domain study, Defining performance parameter, SRS and Peer review, Scheduling, Planing, define input and output	9
Module-3	Design	TDD, Metrics and measurement, Design document, peer review, Validation,	9
Module-4	Implementation and Testing	Demonstration, Test case development, Optimizing Code	18
Module-5	Reprting	Prepare a user manual, Deplymentissue,Make installer,	12

		Critices, Calculate FT – MTTF,MBTF,MTTR etc	
Total			**60**
Evaluation Scheme of PBL (as suggested in Ordinance-PG) **(i) Each fortnightly assessment - 8** **(First assessment will be at the end of 3rd week from the beginning of the semester and thereafter fortnightly assessment. A total of six assessments giving a total percentage** **6 x 8 = 48) = 48** **(ii) Report at the end of the semester - 10** **(iii) Semester end presentation by the students - 10** **(iv) Viva-voce at the end of the semester - 16** **(v) Peer group evaluation (i.e. evaluation by the fellow students not belonging to the same batch)-8** **(vi) Self assessment by the student concerned (can be - 8 moderated by the instructor)** **TOTAL=100**			

1.	Technology specific reference book (#Net,Android, Java, Matlav, Python, MangoDB, Scala etc.
2.	SWEBOK, https://www.computer.org/education/bodies-of-knowledge/software-engineering
3.	ACM Computing Survey, csur.acm.org
4.	IEEE Access, ieeeaccess.ieee.org
5.	PSP(sm), A Self-Improvement Process for Software Engineersby Watts S. Humphrey, Series: SEI Series in Software Engineering

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M21CS121	**Semester** Even **(specify Odd/Even)**	**Semester** II sem (M.Tech -DA) **Session** 2018 -2019 **Month** from **Jan'19** to **June'19**
Course Name	CLOUD BASED BIG DATA SYSTEMS II		
Credits	3-0-0	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr Rajalakshmi
	Teacher(s) (Alphabetically)	Dr Parmeet Kaur Dr. Rajalakshmi

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Outline and classify cloud based big data systems on basis of their features and applicability	Understand (C2)
CO2	Apply MongoDB commands to define, query, manipulate and analyze big data.	Apply (C3), AnalyzeC4
CO3	Manage Big Data and perform data analysis by loading and querying data using Hive	Analyze (C4)
CO4	Utilize HBase for random, realtime read/write access to big data.	C3
CO5	Design a real-world application by using MongoDB or HBase as the database	Create (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Cloud Based Data Stores	Cloud database architecture, Review of NoSQL systems: classification and applications, CAP Theorem	4
2.	Cloud Computing for Big Data Applications	Features of CC, Virtualization for Cloud databases, Amdahl's & Gustafson's law, Transactional models for Cloud Based Applications	4
3.	Document Data Stores	Characteristics of big data applications, Need for document based data stores, MongoDB: documents, CRUD operations, aggregation operations, indexes , replication and sharding	8
4.	Hadoop Framework	Architecture, Key Components, Data Analytics with Hadoop Hive: File Formats, HiveQL, Partitioning and Bucketing, Indexing etc	6
5.	Map reduce Programming Model	Map Reduce programming, MR with MongoDB	3
6.	Columnar, Key Value and Graph Databases	Overview and use of HBase , Redis and Neo4j Databases	6
7.	Multi-tenancy in Cloud Computing	Multi-tenant Database Architecture, Schema Evolution for Shared Databases, Schema mapping techniques for shared	3

		database and shared tables	
8.	DBaaS	Database As a Service, Using Mongo Atlas Service	2
9.	Big Data Programming models	Map reduce vs vertex centric vs data flow models	2
10.	Interoperability and Monitoring of cloud environment	Interoperability of Cloud Storage Systems, Monitoring and Control of Cloud/Big Data solutions	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments (10), Quiz (5), Attendance (10))
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2.	David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013
3.	Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015
4.	Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015
5	Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010

Empirical Research and Performance Evaluation

Detailed Syllabus
Lecture-wise Breakup

Subject Code	17M21CS122	**Semester:** EVEN **(specify Odd/Even)**	**Semester 2nd, Session** 2019 **Month from JAN to MAY**
Subject Name	Empirical Research and Performance Evaluation		
Credits	**3**	**Contact Hours**	L-T-P (3-0-0)

Faculty (Names)	**Coordinator(s)**	1. Dr. Vikas Saxena
	Teacher(s) (Alphabetically)	1. Dr. Vikas Saxena, 2. Dr. Manju

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Critically analyze the published research papers and Summarize literatures on a chosen topic.	Level-4
CO2	Analyze gaps in existing knowledge base & formulate research problems	Level-4
CO3	Develop research proposals, stating its context, scope, input data, standardization, and research methodology.	Level-6
CO4	Will be able to evaluate adequacy of the chosen performance metrics of their as well as peer's research project	Level-5

1.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
2.	Introduction	Meaning, purposes and methods of research, Ethics of research. Article Review. Introduction to The Process of Conducting Research. Reviewing literature, Framing the Research Problem.	10
3.	Basic Research	Introduction to Research Methodology,	10

	Methodology	Identifying research design and Creating Hypotheses, Design theories for given research problem. How novel and interesting is the theory developed?	
4.	Project Based Learning	Introduction to Performance-based learning. Introduction to various strategic methods to evaluate the performance. How to choose the performance measurement model. Introduction to Qualitative Research, inter-disciplinary approach.	10
Total number of Lectures	Performance Evaluation	Identifying the dependent and independent performance parameters/variables, for CSE & IT related developments, as well as specific to chosen domain, Identifying relations between the performance and variables, ideal values, its impact, TDD.	10

Evaluation Criteria		**40**
Components	**Maximum Marks**	
T1	20	
T2	20	
End Semester Examination	35	
TA	25 (Attendance, Assignments, peer review, report and report submission & demonstration)	
Total	**100**	

Recommended Reading material:

1.	C. R. Kothari, Research Methodology: Methods and Techniques, New Age Intl., 1985.
2.	Paul R. Cohen, "Empirical Methods for Artificial Intelligence", 1995, Cambridge, Mass: The MIT Press.
3.	Delbert C. Miller & Neil J. Salkind, "Elements of Research Design", 2002, 6th Edition,
4.	**Andrew A. Chien**, "Communications of the ACM", 1957, **Association for Computing Machinery**
5.	P. Bourque and R.E. Fairley, eds., *Guide to the Software Engineering Body of Knowledge, Version 3.0*, IEEE Computer Society, 2014; www.swebok.org

Large Scale Graph Algorithms & Analytics

Detailed Syllabus

Lecture-wise Breakup

Course Code	17M22CS115	**Semester Even (specify Odd/Even)**	**Semester** M.Tech (II) **Session** 2018-19 **Month from** Jan-Jun
Course Name	Large Scale Graph Algorithms & Analytics		
Credits	3	**Contact Hours**	3-0-0 (3 hrs per week)

Faculty (Names)	**Coordinator(s)**	Dr. Adwitiya Sinha
	Teacher(s) (Alphabetically)	Dr. Adwitiya Sinha

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Extract real-world large-scale data sets through streaming, scrapping, crawling, etc.	Understand Level (Level 2)
CO2	Apply large scale graphs spanning over complex structures	Apply Level (Level 3)
CO3	Design methods to yield required information from large data sources	Creation Level (Level 6)
CO4	Model game theoretic approach to large network creation	Apply Level (Level 3)
CO5	Analyze the evolution process of social web from random graph	Analyze Level (Level 4)
CO6	Analytically discover pattern and perform ranking algorithms	Analyze Level (Level 4)
CO7	Compare performance study of indexing, clustering and classification algorithm	Evaluation Level (Level: 5)
CO8	Propose framework for massive graphs	Creation Level (Level 6)
CO9	Assess behavior of social network using power law distribution	Evaluation Level (Level: 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Large-scale Graphs	Introduction & Application of Large-scale Graph, Characteristics, Challenges, Hyper Graphs, Multi Graphs, Graph Duals	4
2.	Data Sources & Categorization	Complex Data Sources , Categories – Social graphs (Facebook, Twitter, Google+), Endorsement graphs (Web Link Graph, Paper Citation Graph), Technological graphs (Map, Power Grid, Telephone Network), Recommendation Graphs (feedback analysis, product recommendation), Interest graphs, Biological graphs (neural network, food web)	6
3.	Basic Large-scale Graph Analysis	Basic Large-scale Graph Analysis (Efficient Search – Graph Traversal and Search Algorithms; Pattern Discovery -Matching Algorithms, Centrality Computing Algorithms, List Ranking Algorithms; Partitioning – Connected Component Algorithms, Graph-Cut Algorithms)	6

4.	Advanced Large-scale Graph Analysis	Advanced Large-scale Graph Analysis (Graph indexing and ranking – Link Analysis Algorithms, Web Crawling, Page Ranking Personalized Page Rank, Page Rank Axioms, HITS; Data Based Approaches Clustering and Classification Algorithms	7
5.	Distributed Computation for Massive Data Sets	Map Reduce Framework – Large scale Graph Clustering: Spectral Clustering, Modularity-based Clustering, Random Walks, and Pregel Framework.	5
6.	Large Graph Representation & Implementation	Adjacency Matrix Representation, Adjacency List Representation, V-Graph Representation (segmented vectors, storing graph topology), Graph Implementation Strategies & Software (RStudio, Python, Gephi, Pajek, SNAP, NetLogo, etc.)	7
7.	Advanced Research Topics	Power Law Distribution in Social Networks, Models of Power Law Random Graphs, Game-Theoretic Approach to Modeling Network Creation, Rank Aggregation and Voting Theory, Recommendation Systems	7
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
Test-1	20
Test-1	20
End Semester Examination	35
TA	25 (Quiz + Evaluative Assignment + Class Test + Attendance)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall India Learning Private Limited, 1979
2.	Douglas B. West, Introduction to Graph Theory, Pearson Education India, 2015
3.	Matthew O. Jackson, Social and Economic Networks, Princeton University Press, 2010
4.	Santanu Saha Ray, Graph Theory with Algorithms and its Applications, Springer India, 2013
5.	Dieter Jungnickel, Graphs, Networks and Algorithms, Springer-Verlag Berlin Heidelberg, 2013
6.	Reinhard Diestel, Graph Theory, Springer-Verlag Berlin Heidelberg, 2017

Detailed Syllabus
Lab-wise Breakup

Course Code	17M25CS121	**Semester** Even **(specify Odd/Even)**	**Semester** M Tech (DA) 2nd sem **Session** 2018 -2019 **Month from Jan-May 2019**
Course Name	Cloud Based Big Data Systems Lab-II		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Dr Parmeet Kaur
	Teacher(s) (Alphabetically)	Dr Parmeet Kaur

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Outline and classify cloud based big data systems on basis of their features and applicability	Classify Level 2
CO2	Apply MongoDB commands to define and query big data.	Apply Level 3
CO3	Analyze big data with aggregation and Map Reduce frameworks of MongoDB.	Analyze Level 4
CO4	Analyze big data by loading and querying operations of Hadoop Hive	Analyze Level 4
CO5	Assess performance of Hadoop HBase for random, realtime read/write access to big data. [Level 5]	Assess Level 5
CO6	Develop a real-world application by using MongoDB or HBase as the database	Develop Level 6

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Review of Cloud Based Big Data Systems	1. Investigate the concept of Database as a Service. 2. Setup a MongoDB Atlas database cluster.	CO1
2.	GUI based Big Data Analytics platforms	3. Set up a data analytics workflow on KNIME platform.	CO1
3.	Introduction to MongoDB	4. Install MongoDB, Perform MongoDB CRUD operations	CO2, CO6
4.	Aggregation with MongoDB	5. Perform data analysis with MongoDB aggregation operators 6. Perform data analysis with MongoDB Map Reduce framework	CO3, CO6
5.	Introduction to Hadoop Hive	7. Load big data into Hive warehouse 8. Perform queries on data in Hive	CO4, CO6
6.	Scaling with Hive	9. Partition big data present in Hive Warehouse 10. Cluster big data present in Hive Warehouse	CO4, CO6
7.	Working with HBase	11. Insert data in real time into HBase 12. Query data in real time from HBase	CO5

Evaluation Criteria

Components	**Maximum Marks**
1. Lab Test1	20

2. Lab Test 2	20
3. Lab Assignments	25
4. Project	25
5. Attendance	10
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Zikopoulos, Paul, and Chris Eaton. Understanding big data: Analytics for enterprise class hadoop and streaming data. McGraw-Hill Osborne Media, 2011.
2.	Banker, Kyle. MongoDB in action. Manning Publications Co., 2011.
3.	Chodorow, Kristina. Scaling MongoDB: Sharding, Cluster Setup, and Administration. " O'Reilly Media, Inc.", 2011.
4.	Holmes, Alex. Hadoop in practice. Manning Publications Co., 2012.
5.	Lam, Chuck. Hadoop in action. Manning Publications Co., 2010.

Advanced Machine Learning Lab

Detailed Syllabus
Lab-wise Breakup

Course Code	**17M25CS112**	**Semester : Even**	**Semester II**... **Session** 2018 -2019 **Month from Jan- May**
Course Name	**Advanced Machine Learning Lab**		
Credits	1	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Satish Chandra
	Teacher(s) (Alphabetically)	Satish Chandra

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Use Python for implementing fundamental machine learning algorithms	Understanding (Level-2)
CO2	Deploy Neural Network with TensorFlow by accessing and understanding the files that make up a trained model.	Apply (Level-3)
CO3	Apply Deep Leraning Neural networks to model object detection, video tagging, music genre detection etc.	Apply (Level-3)
CO4	Evaluate different deep learning models on the basis of their performances	Evaluate (Level-5)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Python Fundamentals	To write a program for writing the pixel values of an image	1
2.	Python Fundamentals	Write programs for Data Sampling and Visualization	1
3.	Python Fundamentals	Use IPython (a web version provided by Jupyter nootbook) to to write a word count program. Your program should read a text document (download from https://raw.githubusercontent.com/python/cpython/master/	1
4.	Python Fundamentals	Implement neural networks for Classification of *four* character patterns	1
5.	TensorFlow	For the data based on 1990 census data from California.Evaluate the accuracy of a model's predictions using RMSE.	2
6.	TensorFlow	Improve the accuracy of a model of 6 above, by tuning its hyperparameters	2
7.	CNN	Implement CNN using TensorFlow for classifying MNIST images	3
8.	Deep Learning	Use deep learning for music genre classification	3

9.	Deep Learning	Implement AlexNet, GoogleNet and VGGNet and report their relative performance on same dataset.	4

Evaluation Criteria

Components		**Maximum Marks**
Mid Term Evaluation	20	
Periodic Evaluations	20	
End Term Test	20	
Viva	10	
Mini Project	30	
Total		**100**

Recommended Reading material:	
1.	Martin C. Brown, Python: The Complete Reference Paperback, Mc.Grow Hill, 2001
2.	Aurélien Géron, Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Orielly, 2018.

Data Science Programming Lab-II

Detailed Syllabus

Lab-wise Breakup

Course Code	**17M25CS213**	**Semester: Even**	**Semester: II Session** 2018 -2019 **Month from: Jan-May**
Course Name	**Data Science Programming Lab-II**		
Credits	1	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Bharat Gupta
	Teacher(s) (Alphabetically)	Bharat Gupta

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Applying the basic syntax used for data manipulation in Python	Apply Level (C3)
CO2	Apply different methods for Exploratory Data Analysis	Apply Level (C3)
CO3	Apply different metrics for distance calculation	Apply Level (C3)
CO4	Apply and Compare different classification techniques, e.g., k-Nearest Neighbours, Logistic Regression, Support Vector Machine, Ensemble etc.	Apply Level (C3)
CO5	Apply Artificial Neural Network techniques i.e. Feed forward Network, etc. for solving classification problems.	Apply Level (C3)
CO6	Analyse the real world problem to identify the appropriate data science techniques for classification, clustering and Association rules	Analyse Level (C4)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Python fundamentals	Write a python program that displays the sum of all digits for a user entered number. Write a program that outputs all possible strings formed by using the characters a, c, t, o, and g. a particular character can appear only once and all the characters should be used in the formation of string. Write a python script that takes input from file representing a paragraph, and writes to a file named out.txt with all the stop words (a, an, the) removed. In an M.Tech. Program, 10 students register for 5 courses. Write a python program to first display and then plot the highest and average marks in each subject using NumPy and Matplotlib.	CO1
2.	Python for Data	Write python scripts for the following:	CO1

	Science	To get the word count by using dictionary, i.e. how many times each word has appeared in the given text. Storing and accessing data of movie ratings given by a user by using dictionaries in a dictionary Creation and manipulation of tuples Creation and manipulation sets Creation and manipulation list Creating a list from another list - list comprehension Generating an iterator and a generator Passing a function as a variable Embedding functions in another function Passing a function as a parameter Creating anonymous functions with lambda Creating Using the map function Working with filters Using zip and izip Processing arrays from the tabular data Sorting lists	
3.	Exploratory Data Analysis	Write python scripts for the following: Analyzing univariate data graphically Grouping the data and using dot plots Using scatter plots for multivariate data Using heat maps Performing summary statistics and plots Using a box-and-whisker plot Imputing the data Performing random sampling Scaling the data Standardizing the data Performing tokenization Removing stop words Stemming the words Performing word lemmatization Representing the text as a bag of words Calculating term frequencies and inverse document frequencies	CO2
4.	Distance Metrics	Working with different distance measures Calculate Manhattan distance Calculate Euclidean distance Calculate Minkowski distance Calculate Chebyshev distance Working with similarity measures in data points Calculate Cosine similarity Calculate Jaccard similarity Finding outliers in univariate data Discover outliers using the local outlier factor methods	CO3
5.	Classification-I	Download the User Modeling Dataset data and split in training and testing dataset- 70% for training 30% for testing	CO4

		Implement a classification model using logistic regression and k-NN algorithms. Find out the accuracy of classification Model. Perform 5-fold cross- validation. Compare the result of both techniques using graph.	
6	Classification-II	Download the tic-tac-toe dataset and split in training and testing dataset- 70% for training 30% for testing Implement a classification model using logistic regression and Support Vector Machine (SVM) algorithms. Find out the accuracy of classification Model. Perform leave-one-out validation method. Compare the result of both techniques using graph.	CO4
7	Artificial Neural Network	1. Download the User Modeling Dataset and split in training and testing dataset 70% for training 30% for testing 2. Implement a classification model using 2-layer neural network. Using sum-of-square error as loss function. Using Sigmoid activation function. 3. Find out the accuracy of classification Model. 4. Visualize the result using graph.	CO5
8	Ensemble Modeling	1.Download the tic-tac-toe and split in training and testing dataset- 70% for training 30% for testing 2.Implement an ensemble model using logistic regression, SVM and k-NN algorithms. 3. Apply Bagging technique to ensemble. 4. Find out the accuracy of classification Model. 5. Perform 5- cross validation method. 6. Compare the result of both techniques (accuracy and cross validation) using graph.	CO4
9	Mini Project	1. Specify the broad topic of your mini project based on the Data Science. 2. Study minimum 8 quality research papers based on the selected topic. 3. Do the SWOT analysis of selected research papers/reports. 4. Identify the research problem. 5. Propose your novelty/improvement in terms of algorithm/new feature. 6. Design the architecture for the proposed problem. 7. Design the test bed. 8. Design a set of experiments to be carried out for the proposed problem.	CO6

		9. Perform the experimental analysis (in Python language only). 10. Prepare your report. 11. Write a short research paper based on your contribution (10-20 pages).	

Evaluation Criteria

Components	Maximum Marks
Lab Test1	20
Lab Test2	20
Mini Project	30
Regularity and performance	30
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Jiawei Han, Micheline Kamber, Data Mining, Morgan Kaufmann Publishers,Elsevier,2005
2.	Kimball R. and Ross M ,The Data Warehouse Toolkit", Wiley
3.	Pujari, Arun K,Data mining and statistical analysis using SQL, Universities press
4.	Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining
5.	Soumen Chakrabarti, Mining the Web: Discovering knowledge from hypertext data", Morgan Kaufmann, Elsevier
6.	Margaret H. Dunham, Data Mining: Introductory and Advanced Topics, Prentice Hall,2003
7.	Mattison R. ,Web Warehousing and Knowledge Management", Tata McGraw-Hill.
8.	David Hand, Heikki Mannila and Padhraic Smyth ,Principles of Data Mining,PHI
9.	Transactions on Database Systems (ACM)
10.	IEEE Transactions on Knowledge & Data Engineering
11.	The VLDB Journal The International Journal on Very Large Data Bases

Detailed Syllabus
Lab-wise Breakup

Course Code	17M27CS111	**Semester Odd (specify Odd/Even)**	**Semester** II **Session** 2018 -2019 **Month from Jan to** July
Course Name	Project Based Learning I (Open Data Centric Services Development)		
Credits	2	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Tribhuwan Kumar Tewari
	Teacher(s) (Alphabetically)	Monali Mavani, Shilpa Bubhkar

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO.1	Conduct literature review to compare and contrast their project with existing work in the area and prepare a project proposal to be delivered to their peers and faculty members	Understanding Level (Level II)
CO.2	Develop an ability to function in task oriented team, divide role responsibilities to build a project on open data	Understanding Level (Level III)
CO.3	Understand professional and ethical responsibility & acquire ability to communicate effectively amongst team members, peers & evaluators	Analyzing Level (Level II)
CO.4	Analyze and identify Open Source framework for writing data-centric applications over the latest technologies:, .Net Core, C# 7.3, ASP.NET Web API, implementation; plan & submit project development timeline	Applying Level (Level IV)
CO.5	Appraise by giving milestone presentations to their peers and faculty about their current progress.	Evaluating Level (Level V)
CO.6	Prepare technical report detailing the problem statement, proposed methodology, software specification, design, test plan, and implementation details.	Creating Level (Level VI)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Conduct literature review	Conduct literature review to compare and contrast their project with existing work in the area and prepare a project proposal to be delivered to their peers and faculty members	CO.1
2.	Divide role responsibilities to build a project on open data	Develop an ability to function in task oriented team, divide role responsibilities to build a project on open data	CO.2
3.	Communicate effectively amongst team members, peers & evaluators	Understand professional and ethical responsibility & acquire ability to communicate effectively amongst team members, peers & evaluators	CO.3
4.	Plan & submit project development timeline	Analyze and identify various open data frameworks, RESTful APIs, Python libraries for project implementation; plan & submit project development timeline	CO.4
5.	Presentations	Appraise by giving milestone presentations to their peers and faculty about their current progress.	CO.5

6	Prepare technical report	Prepare technical report detailing the problem statement, proposed methodology, software specification, design, test plan, and implementation details.	CO.6

Evaluation Criteria

Components	**Maximum Marks**
Fortnightly assessment	48
Peer group evaluation	8
Self assessment by the student	8
Viva-voce at the end of the semester	16
Semester end presentation by the students	10
Report at the end of the semester	10
Total	**100**

Internet of Things

Detailed Syllabus
Lecture-wise Breakup

Course Code	18M12CS115	**Semester (Even)**	**Semester II Session** 2018 -2019 **Month from Jan to June, 2019**
Course Name	Internet of Things		
Credits	**3**	**Contact Hours**	**3 Lectures**

Faculty (Names)	**Coordinator(s)**	Dr. Prakash Kumar
	Teacher(s) (Alphabetically)	1. Dr. K. Rajalakshmi 2. Dr. Prakash Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Identification of purpose, requirements and description of various components and specifications of IoT devices, applications and protocols.	Understand (level 2)
CO2	Develop the Process Model, Domain Model, Information Model and Service Model specifications using IoT communication protocols.	Apply (level 3)
CO3	Analyze the characteristics and functioning of various IoT specific communication protocols used in different layers of IoT devices.	Analyze (level 4)
CO4	Evaluate various IoT protocols and components for building IoT applications for real world problems and sustainable solutions.	Evaluate (level 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Internet of Things	Introduction to Internet of Things, Layers in IoT, IoT Communication Protocols at different layers, Design steps for IoT, IoT Enabling Technologies, IoT Levels.	5
2.	IoT platforms design methodology	IoT Design methodology, Purpose and requirement specifications, Process, Domain, Information Model specifications, Service specifications and application development.	5
3.	IEEE 802.15.4	The Physical Layer, MAC Layer, MAC Layer Frame Format and their uses.	4
4.	ZigBee	ZigBee Architecture, Association, ZigBee Network Layer, APS Layer, ZDO, Security, ZCL etc.	4
5.	Design Principles for Web Connectivity	Web Communication Protocols for Connected Devices, Message communication Protocols, Web connectivity : SOAP, REST, HTTP RESTFUL, Web Sockets	7

6.	Internet Connecting Principles	Inter Connectivity, Internet Based Communication, IP addressing in IoT, Media Access Control, and Application Layer Protocols: HTTP, HTTPS, FTP, Telnet, etc.,	4
7.	Data Acquiring , Organizing, Processing and Analytics	Data Acquiring and Storage, Organizing the data, Transactions, Business Processes, Integration and Enterprises Systems, Analytics, Knowledge Acquiring, Managing and Storing process	4
8.	Data Collection, Storage and Computing using Cloud Computing	Cloud computing paradigms for Data Collection, Storage and Computing, Cloud Service Models, IoT Cloud-based Services.	6
9.	IoT Applications for Sustainable developments.	Energy Savings in IoT, Green IoT Applications developments for sustainability.	3
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments, Presentations of assigned topics)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Internet of Things: A Hands-On Approach, Arshadeep Bagha and Vijay Madisetti.
2	The Internet of Things: Key Applications and Protocols, Oliver Hersent, David Boswarthick, Omar Elloumi, Wiley.
3.	Internet of Things: Architecture and Design Principles, Raj Kamal, McGrawHill
4.	6LoWPAN: The Wireless Embedded Internet, Zach Shelby, Carsten Bormann, Wiley
5.	Building the internet of things with ipv6 and mipv6, The Evolving World of M2M Communications, Daniel Minoli John Wiley & Sons
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Nature Inspired Computation and Applications

Detailed Syllabus

Subject Code	19M12CS211	**Semester Even**	**Semester Session 2018- 2019** **Month from Jan to June**
Subject Name	Nature Inspired Computation and Applications		
Credits	**3**	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	Dr. Anuja Arora
	Teacher(s) (Alphabetically)	Dr. Anuja Arora

SNO	Description	Cognitive Level (Bloom Taxonomy)
CS211.1	Identify the need of computational complexity, evolutionary, and approximate algorithms.	Apply Level (Level 3)
CS211.2	Understand nature inspired algorithms, its strength, weakness, and suitability	Understand Level (Level 2)
CS211.3	Make use of nature-inspired algorithms to design, learn and optimize problem	Apply Level (Level 3)
CS211.4	Evaluate performance of Nature inspired algorithm in context of problem solving in optimized manner	Evaluate Level (Level 5)
CS211.5	Create a real environment effective artificial system with the use of properties exhibited from nature.	Create Level (Level 6)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Nature Inspired Computation Fundamental	Computational Complexity, NP-Hardness, Reductions, Approximation Algorithms vs. Heuristics, Newton Raphson Method, Characteristics of Natural Systems/Algorithms	5

2.	Empirical and Evolutionary Algorithms	Empirical Algorithms, Empirical hardness. Evolutionary Algorithms, optimization Fitness landscape Analysis, EA Theory	5
3	Evolutionary Algorithms	Genetic Algorithm, GA Encoding Techniques, Selection techniques, Variation(Crossover and Mutation) Techniques, Genetic Programming Differential Evolution Algorithm, sample problems, DE-Crossover and Mutation techniques	8
4	Swarm Intelligence	Particle Swarm Optimization, PSO Sample Problems, Ant Colony Optimization and real life case study solutions, Artificial Bee Colony Algorithm, Gravitational Search Algorithm, Diffusion Search	12
5	Modeling and problem solving	Artificial Neural network, , Artificial Immune System,Self-organizing Maps, Pattern Recognition and Binding, Forest's Algorithm, Harmony Search, Hebbian Learning, Boltzmann Machines	7
11	Case Studies and Applications	World Wide Web, Social Network, Image Processing, Earthquake, routing & scheduling	5
		Total number of Lectures	**42**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Evolutionary Optimization Algorithms, D. Simon (2013), Wiley.
2.	Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies, D.Floreano and C. Mattiussi (2008), MIT Press.
3.	Fundamentals of Natural Computing: Basic Concepts, Algorithms, and Applications, L. N. de Castro (2006), CRC Press.
4.	Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007
5.	Marco Dorrigo, Thomas Stutzle," Ant Colony Optimization", PHI,2005
6.	Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006